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U.S. GENERAL ACCOUNTING OFFICE
STAFF STUDY

PROBLEM AREAS WHICH COULD AFFECT
THE DEVELOPMENT SCHEDULE FOR THE
CLINCH RIVER BREEDER REACTOR

ATOMIC ENERGY COMMISSION

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ABBREVIATIONS

ACRS	Advisory Committee on Reactor Safeguards
AEC	Atomic Energy Commission
CRBR	Clinch River Breeder Reactor
EFTF	Fast Flux Test Facility
LMFBR	Liquid Metal Fast Breeder Reactor
PMC	Project Management Corporation
R&D	Research and Development

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INTRODUCTION

The General Accounting Office is monitoring the Atomic Energy Commission's (AEC's) progress under its Liquid Metal Fast Breeder Reactor (LMFBR) program which has been this Nation's highest priority civilian reactor program for the past several years. The primary objectives of the program are to develop (1) the necessary technology for designing and constructing LMFBRs for safe, reliable, and economic operation and (2) a competitive, self-sustaining industrial LMFBR capability by the mid-1980s. In this effort, we are alert to potential problem areas or issues which could impede the development schedule of the Clinch River Breeder Reactor (CRBR)--this Nation's first liquid metal fast breeder reactor demonstration project scheduled to be operational in 1982. The CRBR was initially estimated to cost about \$700 million but recent preliminary revised estimates show that the reactor could cost as much as \$1.7 billion. 743

We have learned of two such problem areas which could lead to overall schedule stretchouts and increased costs: (1) slow progress being made by the project participants in transmitting to AEC's Regulatory organization adequate design information which is needed in the safety pre-application review phase to facilitate licensing of the reactor and (2) a difference of opinion between AEC's Regulatory organization and the CRBR project participants concerning the timeliness and sufficiency of AEC's current efforts to resolve a CRBR safety issue.

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AEC's top management is aware of these problems and has initiated actions to resolve them; however, improvements in these areas are not yet noticeable. This staff study presents the facts surrounding these problem areas, the impact that these problem areas could have on the CRBR schedule if not timely resolved, and actions AEC is taking to resolve them.

This study was reviewed by AEC officials associated with the management of the CRBR project and by officials of the Regulatory organization and their comments have been considered in finalizing this study. We know of no residual differences in fact.

Copies of this study are being sent to the Joint Committee on Atomic Energy, the House and Senate Committees on Appropriations and interested members of Congress. The Committees may wish to review what is being done to resolve these problems in connection with future authorization and appropriation requests.

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PROBLEMS ENCOUNTERED IN PRE-APPLICATION SAFETY REVIEW PHASE

One of the principal objectives of the CRBR project is to verify that breeder reactor powerplants can be licensed for commercial operations. Therefore, the CRBR will be subjected to the same licensing process as other commercial reactors.

The AEC Regulatory organization's licensing schedule calls for a pre-application review of CRBR project information. During the pre-application phase the applicant submits to the Regulatory organization site suitability, environmental, and safety information. The

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Regulatory organization reviews this information before receipt of the formal license application. The purpose of the pre-application review is to identify issues that need to be resolved early and to alert project participants to areas where the Regulatory organization believes the CRBR development approach could be improved. A regulatory organization official told us the bulk of the pre-application review effort for the CRBR has been directed at safety aspects of the project. Our study of the CRBR pre-application review phase focused on those safety aspects.

Correspondence between the Regulatory organization and the project participants indicates that the Regulatory organization is still awaiting design information needed to perform the pre-application safety review.

The Regulatory organization's CRBR licensing review is scheduled to start in January 1975 and to be completed in March 1976--a 14-month period. The CRBR licensing review schedule is essentially the same as that for light water reactors. This review schedule is based upon, and contingent upon

- the project participants submitting safety information to the Regulatory organization which is of a high quality and adequately documented during the pre-application review phase and
- the early identification and resolution of key safety-related design issues.

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In a November 23, 1973 letter to the Project Management Corporation (PMC)--the corporation responsible for managing the project--the Director of Regulation said that:

"In view of the advance nature of the concept [LMFBR] and the extensive associated research and development to be carried out in parallel with the design and construction of the project, it is important that we receive all data pertinent to safety and environmental requirements on a continuing and timely basis before, as well as after submittal of your application."

In a March 14, 1974 meeting, the project participants discussed with the Regulatory organization the project position on the overall CRBR safety approach, on the role of research and development, and the identification of safety issues. However, in an April 10, 1974 letter to the PMC General Manager, commenting on the meeting, the Assistant Director for Advanced Reactors, Directorate of Licensing, indicated that

"The meeting provided the Regulatory staff with only limited additional basis for proceeding with the pre-application phase of the review." (Underscoring supplied.)

By letter dated May 28, 1974, the Assistant Director for Advanced Reactors, Directorate of Licensing, advised the PMC General Manager that

"We are in urgent need of certain definitive technical information to aid in clearly identifying and resolving any significant issues so that the forthcoming licensing review can be continued on schedule following submittal of the PSAR [Preliminary Safety Analysis Report]."

On June 3, 1974, the General Manager of PMC gave the Regulatory organization a document describing its CRBR project design safety

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approach. However, on July 3, 1974, the Assistant Director for Advanced Reactors, Directorate of Licensing, informed PMC that

"We have reviewed the Summary of Design Safety approach for the CRBRP transmitted by your letter of June 3, 1974 *** In accordance with your request, we have arranged a meeting between PMC and the Regulatory Staff for July 30, 1974, to discuss your approach and implementation. At that time, we would appreciate PMC providing details of the approach and its implementation, including identification of the specific design criteria, requirements and features which are utilized as a consequence of the adoption of your approach. We anticipate that effective communication of this information will require the provisions of significant design information to Regulatory." (Underscoring supplied.)

In a memorandum dated July 8, 1974, to the AEC General Manager, an AEC Commissioner expressed concern over the timeliness and quality of information being submitted to the Regulatory organization. He stated

"With particular regard to the CRBR, it is my understanding that the Regulatory schedule for review of the license-related documentation was predicated upon receiving advanced project documentation and supporting information in segments as it became available in order to allow the Regulatory staff to become generally familiar with the CRBR project as quickly as practical. Thus this approach would tend to minimize delays by increasing the possibility that important issues would be identified in a timely manner. It is my understanding, however, that this has not developed at the anticipated rate and that the only project information transmitted to the Regulatory staff to date has been a statement of the CRBR safety philosophy. Further, it is important that the project schedule now under development be realistic with regard to the necessary licensing actions and reviews, and the time intervals used in the preparation of this schedule have the general agreement of the Regulatory staff." (Underscoring supplied.)

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A meeting was subsequently held between Regulatory officials and the AEC General Manager on August 8, 1974. A summary of that meeting, prepared by the Assistant Director for Advanced Reactors and submitted to the AEC General Manager by the Director of Regulation on August 16, 1974, shows that the Regulatory organization was still concerned that it was not getting information it needed to expedite the pre-application review.

"The established Regulatory review schedules are essentially the same as those for current LWR /light water reactor/ applications, but that meeting these schedules for the CRBR is contingent on a significant pre-application effort, during which Regulatory would receive project design information and significant issues would be identified. A high level of quality in the application documents would also be necessary to enable review schedules to be met. Although Regulatory has had a number of meetings with project representatives and there have been an exchange of letters, all of the meeting summaries and letters being in the public document room, the necessary amount of design information on the project had not been made available to accomplish the pre-application review purpose. However, significant issues are evident where Regulatory and the Project disagree on safety criteria and project safety design bases, but no progress in resolving these issues is discernible to Regulatory." (Underscoring supplied.)

The Regulatory organization's current position is that the 14-month licensing review schedule can be met if it receives the safety information before January 1975. If the information is submitted piecemeal after that time, completion of the review will depend on the quality and nature of the information.

As of the time we finalized this study, the General Manager of AEC was still in the process of preparing a response to the AEC Commissioner's memorandum of July 8, 1974. The Director of the Reactor

Research and Development Division told us that the project participants plan to satisfy the Regulatory requirements for safety-related information by holding meetings with the Regulatory organization on a continuing basis.

UNRESOLVED SAFETY ISSUE

Safety is a major technical aspect of the LMFBR development program. AEC places significant emphasis on reactor safety and estimates that about \$40 million of the projected \$307 million FY 1975 operating cost for LMFR research and development (R&D) will be devoted to the safety program. Estimated total operating cost for the LMFBR safety R&D program from FY 1975 through planned commercial introduction of the reactor in 1987 is approximately \$600 million.

An important part of AEC safety R&D is the understanding of postulated accidents. From analysis of postulated accidents, several accident sequences are selected as a basis for the design and incorporation of features in a reactor which provide additional margins of safety in the event of extremely unlikely and unforeseen circumstances. One such accident postulated for the CRBR is a core disruptive accident. A core disruptive accident causes structural failure of the core (central portion of the reactor containing the nuclear fuel).

A currently unresolved safety issue is whether the CRBR will be designed so that it will acceptably accommodate the consequences of a core disruptive accident. The Regulatory organization holds that the state of LMFBR technology and AEC's planned schedule and scope of R&D

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prior to important design and construction decisions are not sufficient to prove a core disruptive accident is incredible, or beyond belief, and that the CRBR should include a core disruptive accident in the spectrum of design basis accidents. Accommodation of a core disruptive accident, according to the Regulatory organization, may require additional features, such as a core catcher¹, to lessen the consequences of a core disruptive accident.

The project participants hold that a core disruptive accident of a magnitude which would lead to uncontrolled amounts of core debris is incredible. Therefore, they believe that a core catcher and other additional features designed to accommodate a core disruptive accident are not needed in the CRBR. Although adequate quantitative assessments are not currently available to conclusively prove that such an accident is an incredible event, project participants are confident that ongoing R&D efforts will prove their contention, and will convince Regulatory that a core catcher is not needed. However, in the event that the ongoing R&D fails to show that a core catcher is not needed, the project participants recently started work on an alternate CRBR design which includes a core catcher.

The Director of AEC's Reactor Research and Development Division stated that this alternate design will parallel the reactor's reference design. The reference design describes the specifications to which the plant is to be built. According to him the alternate design would

¹A core catcher is a device located below or at the bottom of the reactor vessel which in the event of a core disruptive accident, will spread out the core debris. This would prevent material from reforming into a mass capable of a chain reaction, and prevent core residue from melting through the bottom of the reactor.

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become the reference design as decision points in the CRBR development schedule are reached. As an example, he said that should the decision point be reached to order the materials needed to build the core catcher and the ongoing R&D has not proven that the system is unneeded, the material would be ordered. He further stated that the project participants are firmly committed to maintaining this parallel design effort as a viable alternate. This alternate design effort is estimated to cost \$3.25 million.

Of significant concern to project participants is the possibility that including the unproven and expensive core catcher--estimated to cost \$20 to \$60 million--in the CRBR will lead to a requirement for such devices in future commercial plants. Some project participants are concerned that including core catchers would make LMFBRs less commercially attractive to the utilities.

As previously stated, the Regulatory organization does not expect AEC's R&D programs to prove the project participants' position that a core disruptive accident is an incredible event before important design and construction decisions must be made on the project. The Regulatory organization maintains that accommodation of a core disruptive accident should be included in the design basis, and that features necessary to accomplish this should be included in the reference design to ensure their viability and cause the least disruption should they be eventually required.

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The Regulatory concern stems partially from its experience with the Fast Flux Test Facility (FFTF) project--a test reactor being constructed primarily to develop advanced fuels for LMFBRs. In June 1971 the AEC division responsible for developing the FFTF outlined a suggested basis for proceeding with construction of the reactor pending completion of the Regulatory organization's safety reviews. One of these suggestions was that a space be left in the reactor for a core catcher should the need for such a system be demonstrated.

In a January 13, 1972 report on the FFTF to the AEC Chairman, the Advisory Committee on Reactor Safeguards (ACRS)¹ restated its agreement with the suggestion that space be retained in the reactor for a core catcher and recommended that

"*** an intensive program be started now to develop an ex-vessel, post-accident core retention and cooling system /core catcher/ suitable for installation below the reactor, so that the required information will be available in time to enable installation prior to reactor startup, should the system be needed."

Later in February 1972, the Regulatory organization made a similar recommendation. However, although a space was left in the FFTF for a core catcher, a core catcher design was not developed. In a May 30, 1974 letter to Regulatory, the Acting Assistant Director for the FFTF Project stated that

¹The Advisory Committee on Reactor Safeguards (ACRS) was established in 1957 by Section 29 of the Atomic Energy Act of 1954, as amended. The Committee reviews safety studies and facility license applications referred to it and advises the Atomic Energy Commission with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards. The Committee members are appointed by the Commission for 4-year terms.

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"The current project position on the need for ex-vessel cooling is the same as has been reported previously in the Regulatory review process. Capability for installation of such a device [core catcher] (space and access) is being retained during construction *** our current assessment continues to be that an ex-vessel core retention device [core catcher] is not a required design feature. Design and installation of an ex-vessel core retention device would be initiated only if the continuing evaluations of the FFTF design and safety indicate such a system to be necessary." (Underscoring supplied.)

Regulatory has now expressed concern that there appears to be a retreat from the principle of retaining the capability to install a core catcher in the FFTF, and that design decisions and construction progress are constraining the practicality of implementing fallback features, such as the core catcher.

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Because of the declining availability and increased cost of fossil fuels, this Nation is placing a heavy dependence on using nuclear power to satisfy the projected growth in electrical energy demand. The LMFBR is this Nation's highest priority reactor development program to help satisfy our energy demands and extend our uranium resources.

Over the past several years, public and congressional concern has grown over AEC's LMFBR development efforts and, more specifically over the progress AEC and the project participants are making towards developing and constructing the first LMFBR demonstration plant--the CRBR. For example, in the Joint Committee on Atomic Energy's authorization report for fiscal year 1975, the Committee stated

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as follows regarding the need for AEC to exercise more effective management of the CRBR and effectuate more timely decisions over CRBR matters:

"The committee is disappointed and concerned about the inordinate delays that have occurred in moving this project forward on the high-priority basis set by the President. Advance procurement of materials and other preconstruction activities have been tardily instituted. For example, Commission approval for PMC to order long leadtime materials for the project was not provided until February 1974. To this day, the Commission has not approved the placement of orders for components. This early record of indecision and slowdown is difficult to understand in view of the high priority national effort this project represents. Delays of this type inevitably mean overall schedule stretchouts and increased costs. The committee believes that much of the delay is attributable to the conduct of AEC's role. The committee urges the Commission to centralize, invigorate and execute its lead role functions in the timely, effective, and high-priority manner contemplated by the authorization, national commitment, and Presidential direction for this project."
(Underscoring supplied.)

The Regulatory organization believes that AEC's current research program may not be sufficient to resolve the question of whether a core catcher is needed before important design and construction decisions for the CRBR must be made. Furthermore, the project participants have been slow in giving the Regulatory organization adequate information to complete its pre-application safety review. Delays in resolving these types of problems could lead to overall schedule stretchouts and increased costs.

AEC is aware of these problems and one of the Commissioners is trying to find ways to expedite resolution of the safety problem and to improve the quality of information being given the Regulatory organization for its pre-application safety review.

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Furthermore, on October 2, 1974, the AEC Commissioners requested that a review be made of the LMFBR program and the CRBR by the AEC staff. This review is to reassess the need for the LMFBR in light of the latest information available and determine whether the purpose and timing of the CRBR are compatible with that need and the state of LMFBR technology. One topic to be covered during the review is whether the CRBR schedule is compatible with the licensing process and whether there are safety issues which should be resolved before the plant design can be approved. A report on the review was scheduled to be completed in December 1974.